

Part II

Cycles of Matter and Energy

Cycles Science Objectives and Research Focus Areas

NASA Agency Goal: Explore the Solar System and the Universe beyond.

Science Objective 4. Explore the cycles of matter and energy in the evolving Universe.

Research Focus Area 8. Determine how, where, and when the chemical elements were made.

Research Focus Area 9. Understand how matter, energy, and magnetic fields are exchanged between stars and the gas and dust between stars.

Research Focus Area 10. Discover how gas flows in disks and how cosmic jets are formed.

Research Focus Area 11. Identify the sources of gamma-ray bursts and cosmic rays.

Science Objective 5. Understand the development of structure in the Universe.

Research Focus Area 12. Discover how the interplay of baryons, dark matter, and gravity shapes galaxies and systems of galaxies.

Research Focus Area 13. Explore the behavior of matter in extreme astrophysical environments.

Research Focus Area 2. Determine the size, shape, age, and energy content of the Universe.

Research Focus Area 4. Determine how black holes are formed and how they evolve.



active
galactic
nuclei



dusty
galaxies



supernovae

The intellectual challenge for the SEU theme encompasses the birth, death, lifecycles, and interrelationships between galaxies, stars, black holes, and the gas, dust, and radiation fields that permeate the space between them.